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REMARKS/ARGUMENTS

Reconsideration is requested in view of the following remarks. Applicants wish to thank the Examiner for confirming this Office Action is a non-final Office Action. Claim 1 has been editorially revised to include the limitations of claim 2. Claim 2 has been canceled. Claim 28 has been similarly revised. Claims 1 and 3-28 remain pending in the application, with claims 9-27 withdrawn. Although the original Figures alone are more than sufficient to a complete understanding of the embodiments described in the specification, exemplary Figures I, IIa, IIb and III are attached to further render support in understanding how the specification allows one skilled in the art to make and/or use a superlattice structure in a recording layer, and to make and/or use a magnetic recording medium.

Claim Rejections – 35 USC §112

Claim 1 is rejected under 35 U.S.C. §112, first paragraph. The rejection asserts the specification does not enable a skilled artisan to make and/or use a super lattice structure in a recording layer. Applicants respectfully traverse this rejection.

In order to use a magneto-optical recording material according to the principles of the invention described in the specification as a high-density magnetic recording medium, it is required that the magnetization is oriented perpendicular to a film surface and small magnetic domains can be present stably as shown in the exemplary Figure I attached herein, and such as also shown in Figure 2A. In other words, the diameter d (W1 in Figure 2A) of the minimum cylindrical magnetic domain has to be made smaller in a high-density magnetic recording medium.

Assuming herein that a coercive force is Hc and saturated magnetization is Ms, the following relationship is established: $d \propto 1/Ms \cdot Hc$.

From the above relationship, and since the diameter of a cylindrical magnetic domain is inversely proportional to the coercive force energy Ms·Hc, Ms·Hc has to be made larger. However, since it is difficult to orient the magnetization of a material with large saturated magnetization Ms perpendicularly, a material having a large coercive force Hc is especially desirable.

Further, while the saturated magnetization Ms is determined from the material and its composition ratio, the coercive force Hc has characteristics depending on the composition and characteristics depending on the miniscule structure of the film.

Therefore, even in the case of recording films having the same composition, their coercive forces Hc can be larger in a recording film having a miniscule structure as shown in attached exemplary Figure IIb than in a recording film as shown in attached exemplary Figure IIa having a uniform amorphous structure.

That is to say, as shown in the graph of exemplary Figure III attached herewith, if the recording films shown in exemplary Figures II(a) and II(b) have the same composition, they show the same temperature characteristics concerning Ms. On the other hand, they show different characteristics concerning Hc, even when they have the same composition, and Hc can be increased in a recording film having a miniscule structure such as shown in exemplary Figure II(b). That is to say, in contrast with that disclosed by the conventional art, Ms·Hc can be increased (i.e., the diameter d of the minimum cylindrical magnetic domain can be decreased).

As a method for forming a recording film having a miniscule structure, the inventors of the present invention found a process of laminating layers alternately using a plurality of targets made of different materials or different compositions as shown in exemplary Figure III. For instance, as a specific example of the manufacturing method, the amount of active impurity gases such as O_2, H_2O, N_2 and H_2 is set at a predetermined value or lower with reference to an inert film formation gas (Ar gas in Embodiment 1), whereby the formation of an impurity layer (e.g., an oxide layer) at an interface of the laminated layers can be prevented. Thereby, the effect of magnetic characteristics resulting from interfaces of magnetic thin films having a periodic lamination structure can be utilized effectively, thus realizing a recording layer having a large coercive force. As another example, the specification describes Embodiment 6, where a miniscule convexo-concave pattern formed on a substrate can increase a coercive force. The coercive force energy Ms·Hc can therefore also be increased.

As stated above, according to the principles of the claimed invention, even when the same composition as in the conventional art are used, the coercive force Hc is made larger, whereby high-density recording can be realized. In view of the foregoing, the

rejection should be withdrawn. The foregoing discussion clearly shows that one skilled in the art can make and/or use a superlattice structure in a recording layer based on the descriptions in the specification describing particular embodiments of the claimed invention.

Claim 2 is rejected under 35 U.S.C. §112, first paragraph. The rejection asserts the specification does not enable a skilled artisan to make and/or use a recording medium satisfying the product of the coercive force and saturated magnetization relationship that approaches infinity (∞). Applicants respectfully traverse this rejection.

Since a coercive force and saturated magnetization are finite values, the product of the coercive force and the saturated magnetization naturally is a finite value. The product of the coercive force and the saturated magnetization can be made a predetermined value or more by increasing the coercive force using the above described methods.

In view of the foregoing, one skilled in the art can make and/or use a magnetic recording medium as recited in claim 2, now incorporated into claim 1, based on the descriptions of the claimed invention as set forth in the specification.

Claim Rejections – 35 USC §102/103

Claims 1-8 and 28 are rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Shiratori et al. (US 6,027,825). Applicants respectfully traverse this rejection.

Claim 1 is directed to a magnetic recording medium wherein the recording layer is formed so that a product of a coercive force Hc and saturated magnetization Ms of the recording layer (Ms·Hc) at room temperatures is increased sufficiently so that a shortest mark length of the recording layer can be decreased to a desired value, and the product Ms·Hc of the coercive force Hc and the saturated magnetization Ms is no less than 3×10^6 erg/cm^3. Nowhere does Shiratori et al. disclose or suggest that Ms·Hc is increased sufficiently to obtain a higher recording density (i.e., a shortest mark length of the recording layer can be decreased to a desired value).

One embodiment of the claimed invention is described in the specification in which a recording layer having a periodic lamination structure, such as recited in claims 6-8, of a predetermined thickness (miniscule convexo-concave pattern formed on a substrate) can increase Ms·Hc (for example, see Fig. 4 and also see exemplary Figure III showing (b)Hc). Shiratori et al. neither disclose nor suggest a recording layer having a periodic lamination structure of a predetermined thickness to increase Ms·Hc.

Shiratori et al. disclose only a laminated structure of the second magnetic layer and the third magnetic layer. In contradistinction, the claimed invention recites a recording layer itself that requires a periodic lamination structure of a predetermined thickness.

Further, Shiratori et al. describe that the saturated magnetization Ms at room temperatures of the third magnetic layer as a recording layer is substantially zero, and therefore it is impossible to increase the product Ms·Hc sufficiently simply by increasing the coercive force Hc (see (a)Hc in exemplary figure 3). The effects of increasing Ms·Hc and stabilizing miniscule recording marks (i.e., decreasing a shortest mark length of the recording layer to a desire value,...) cannot be obtained from the invention disclosed by Shiratori et al.

The foregoing remarks apply equally to claim 28. For at least these reasons, claims 1 and 28 are patentable over Shiratori et al. Applicants do not concede the correctness of the rejection. Claims 3-8 are also patentable over Shiratori et al. since they depend ultimately from claim1 that is allowable. Claim 2 has been canceled, thus rendering this rejection moot.

Favorable reconsideration in the form of a Notice of Allowance is requested. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone Applicants' primary attorney-of-record, Douglas P. Mueller (Reg. No. 30,300), at (612) 455-3804.

Respectfully submitted,

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